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(54) **Lining sewers**

(57) A pipe or sewer is lined, by first applying an insulating intermediate layer 2 e.g. polyurethane foam and then applying a mechanically and chemically stable sealing layer 3 e.g of epoxy resin.

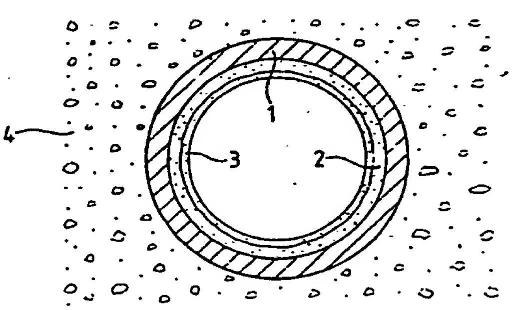

FIG. 1

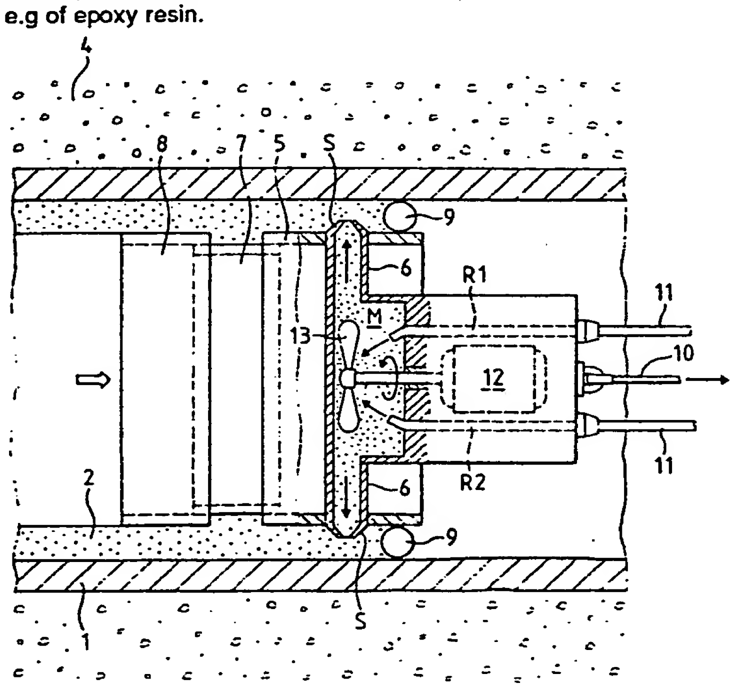

FIG. 2

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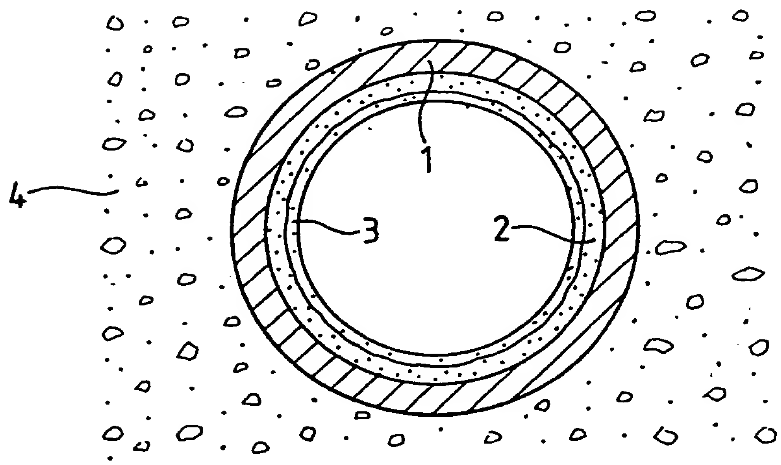

FIG. 1

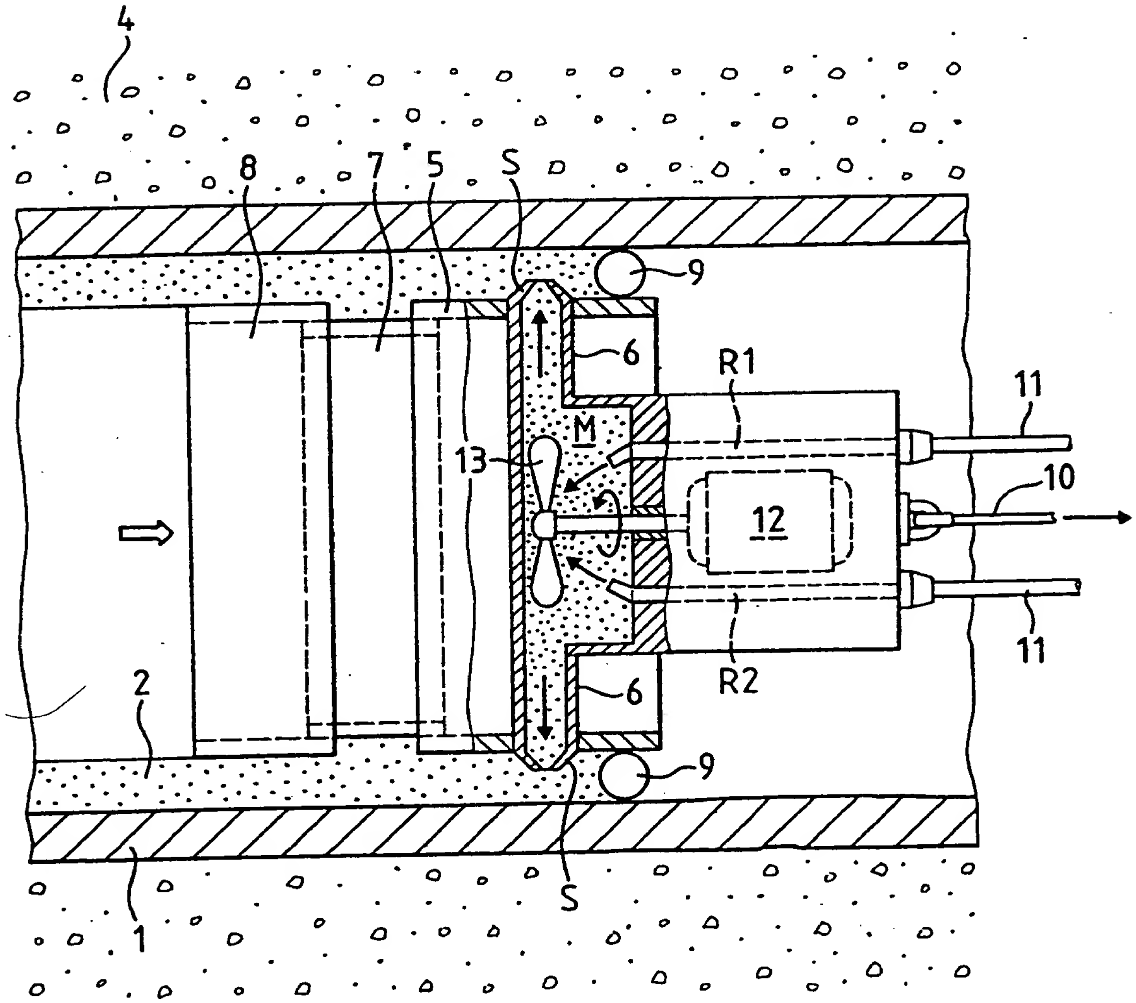

FIG. 2

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Process for sealing damaged pipes.

The invention relates to a process for sealing damaged or faulty pipes and to an apparatus for performing the process.

The sealing of damaged pipes, particularly sewer pipes has its own special problems. Several factors occur together if a damaged sewer has to be repaired. The damaged points can merely be fine cracks, which are just large enough to leak, but can also be arm-thick breaks which lead to an unhindered passage of the sewer content into the surrounding ground. Usually these damaged points are underneath a sludge layer and are very much exposed to the wet. Sewer pipes, which in certain circumstances can have a man-high width, are usually difficult of access or inaccessible to humans, even in the case of large diameters. Without exception, it is also cold in the underground sewers. The medium is influenced by methane and other gases. In addition, generally only the obvious damage (leaks) can be detected, whereas the preliminary stages which can grow so as to constitute visible damage points are not readily detectable. Therefore shortly after repairing a sewer, it can again have leaks subsequently formed at such non-detectable points.

In order to obviate the aforementioned problems, a number of procedures have been developed enabling such pipes to be repaired. However, they have only lead to a displacement of the problems. Instead of the damaged points being observed and repaired by a human, this is now done by machines, which are also susceptible to damage. Such machines e.g. drill the damaged points found and backfill them with synthetic resins (e.g. WO-86/03818) or another apparatus is used for priming and in this way sealing the damaged point (WO-86/04975). Another procedure involves

the virtual replacement of a complete pipe section with the damaged point or points by drawing in a resin-impregnated tube, which is inflated in the damaged pipe and subsequently cured, e.g. according to EP-0 082 212, DE 35 13 956 and WO-87/04226.

All these methods use hardenable synthetic resins (resin systems) and the basic problem in connection therewith is their curing. In the medium in which such synthetic resin systems must cure or completely harden is encountered dirt, wet, cold, constricted conditions and other unfortunate circumstances, i.e. in no way ideal conditions to reliably and permanently obtain a hardened resin layer with a long service life.

Theproblem of the present invention is to provide a process for repairing pipes, which can be simply used, which requires no complicated mechanical equipment and which leads to continuous pipe coatings, which rapidly and reliably completely harden and which in a relatively short time can be used again, whilst having long service life characteristics. The necessary apparatus must be inexpensive and simple to operate and maintain.

This problem is solved by the invention given in the independent claims.

Various embodiments of the invention are discussed hereinafter with respect to the following drawings.

Fig.1 shows in cross-section a sewer pipe laid in the ground, which has an insulating intermediate layer formed from a foam resin and a bearing hard, smooth and impermeable epoxy resin inner layer. Compared with the size of the sewer pipe, the layer thicknesses have been greatly exaggerated. In reality the thickness of the

intermediate layer is preferably 0.5 to 1.5 cm and that of the bearing inner layer preferably 0.5 to 1.5 mm.

Fig.2 shows in longitudinal section a sewer pipe and diagrammatically an embodiment of an apparatus for applying the insulating intermediate layer. The apparatus in which the resin components are brought together, mixed and injected, draws or drags a shaping pipe with it, which forms a circular gap between the mould and the sewer pipe, which is filled with curable foam. The shaping pipe is in multisection form and adapts to any pipe bends.

The resin systems (generally polyesters) used for repairing the faulty or damaged pipes are generally thermosetting, so that adequate heat energy must be supplied to the resin mixture in order to allow the complete chemical hardening to take place. The damaged pipe (e.g. wetted concrete) together with the soil surrounding said pipe forms such a large heat sink behind the resin layer to be hardened that only with considerable effort is it possible, if at all, to supply sufficient thermal energy to cure the resin, so that e.g. the necessary strength and/or long service life can be obtained.

Thus, in one of the aforementioned prior art examples the heat is supplied to the resin system to be hardened by water, which has a high specific thermal capacity, so that the tube which has just been resined must be inverted over the sewer pipe, because hardening cannot take place in an aqueous medium.

Although water is a sufficiently good energy carrier and is also inexpensive, other methods have been proposed,

namely supplying the energy by UV-radiation to the resin system, which can only be in polyester form. Thus, resined tubes have been inflated in the pipe and subsequently irradiated with UV. UV-hardened resins suffer from the disadvantage that they more easily become brittle and are more readily attacked by bacteria. Pipes treated in this way and inserted in damaged pipe systems will not have an adequate service life. In addition, the costs for obtaining completely satisfactory radiation hardening are high.

A further possibility consists of the curing of a hardenable resin with gases, to which is added a hardening component. This can take place at the same time as the pumping up of the tubular carrier for the resin system introduced into the sewer. The hardening gas is allowed to flow through the resin-coated tube until curing has taken place. However, gas hardening only makes it possible to obtain thin coatings, whose strength is often inadequate in the pipe. The gas layer cured on the surface acts as a barrier between the hardening gas and the underlying resin material to be hardened.

This lead to the idea of producing for the resin system used for providing the strong pipes a medium in which problem-free curing can take place, leading to a wall (pipe) structure, which has the necessary strength. As the curing is chemically complete, such a resin layer will also achieve the necessary service life.

Between the resin layer forming the inner, new sewer pipe and the aforementioned heat sink outside the resin layer to be hardened is placed an insulating layer, i.e. an intermediate layer, which keeps away dirt and wet and which forms a barrier against the passage of heat energy. Apart from an adequate mechanical strength, this insulating intermediate layer must form a chemically adequately good

substrate, so that a hard, resistant resin layer is formed thereon. In order to realise this, it is necessary to find a material satisfying all these requirements and which also can act as an intermediary between the outside world and the protected medium, whereby it is compatible with such an outside world of dirt, wet, microbes, etc. The material is preferably a polyurethane resin.

This specific problem was also solved by the invention described in Swiss Patent Application 01849/88-7. The latter deals with the complete problem on the basis of a new idea. For the resin system to be used for forming the desired strong pipes is created an environment, where a problem-free curing can take place. Thus, as curing is chemically complete, the applied resin layer will also have the requisite service life. Between the resin layer forming the inner, new sewer pipe and the said heat sink outside the resin layer to be hardened, is placed an insulating layer, i.e. an intermediate layer, which keeps away the dirt and wet and forms a barrier against the passage of thermal energy. Apart from an adequate mechanical strength, this insulating intermediate layer must also form an adequately chemically good substrate to enable a had, resistant resin layer to form thereon. In order to achieve this, it was necessary to find a material fulfilling all these requirements and, as the intermediary between the outside world suitable for the resin lining and the shielded medium for applying the resin coating, must also be compatible with such an outside world of dirt, wet, microbes, etc. This material is preferably a polyurethane resin.

The following procedure is adopted for repairing leaky sewer portions. The pipe to be repaired, whose leaky points have been detected beforehand, is washed out according to a known procedure. Following a basic drying, the still wet pipe (which must not have any water puddles

and these should be sucked off if necessary) is completely foamed in a spraying process with a polyurethane resin system, e.g. of type Polylite VP-626 RG30/8664. The component Polylite VP-626 RG 30 contains polyether polyols and the component Polylite 8664 contains a reactive isocyanate. The mixing ratios can be gathered from the data sheet and instructions provided by the manufacturer, as can the mixing and foaming requirements.

By using a corresponding foam spraying machine, this resin system can be applied vertically and horizontally overhead to particularly difficult surfaces, as well as in cavities therein. As stated, this resin system contains reactive isocyanate, so that contact with the skin, eyes and clothing must be avoided. Mechanical spraying taking place in remotely controlled manner without any direct human assistance is very advantageous here. When working or handling these substances protective goggles must be worn and possibly also protective gloves and a respiratory mask.

The indicated resin system is self-foaming at ambient temperature. It is possible as a result of the short cream time and tack-free time to insulate particularly difficult surfaces in a very short time. Despite the low density, the foam has good mechanical characteristics. Compared with its weight, the cured foam has a high strength and excellent insulating characteristics.

Such a resin system leads to an over 90% closed-cell layer with a heat transfer coefficient of 0.015 to 0.025 kcal/mh°C, which is completely adequate for the 0.5 to 1.5 cm thick layer required here. The cream time is 2-3 sec and the tack-free time 10-15 sec., whilst the ideal mixing temperature if 20°C. The compressive strength of the cured foam is 2 kJ/m^2, so that further processing or working within the pipe structure is readily possible. The short curing time, which can be assisted by introducing hot

air, makes it possible with an apparatus of the type described hereinafter to achieve a pipe coating speed of up to approximately 2m/min, which is a very satisfactory.

The further working in the now insulated sewer consists of applying a further resin layer, the actual "pipe", which is now sprayed onto the insulating layer. Preference is given to the use of an epoxy two-component resin, e.g. Araldite, which even in the form of a thin coating of approximately 0.2 to 1.5 mm forms a sealing insert with the necessary stability. As this resin system is applied to the previously formed, insulating substrate, it is subsequently possible to thermoset in problem-free manner, e.g. with heated air. The supplied air is not then lead off into the environment, being instead stored in the resin, so that the entire energy is available for hardening purposes. This second resin layer is then the mechanically strong, sewer-sealing layer, which comes into directe contact with the content carried in said pipe.

If necessary, a further, final layer of the same resin material with a different viscosity can be applied, in order to make the surface even more fine-pored and smoother from the flow standpoint, whilst at the same time increasing the pipe thickness.

Fig.1 diagrammatically shows in cross-section a sewer pipe 1 in the ground 4 and which is generally formed from thoroughly wetted concrete, which has a foam resin insulating intermediate layer 2. The foam resin, a PUR, after a certain pretreatment of the basically dried and still moist to wet concrete surface has an adequate adhesion. A description of this pre-treatment will be given hereinafter.

A bearing, hard, smooth and impermeable epoxy resin inner coating 3 is applied to the intermediate coating and said substrate is chemically and physically suitable for the connection. The coating thicknesses have been exaggerated compared with the sewer pipe. In reality the intermediate coating is preferably 0.5 to 1.5 cm thick and the bearing inner coating preferably 0.5 to 1.5 mm thick.

Everything now depends on the flow requirements within the sewer. If for flow reasons importance is attached to a very smooth and uniformly rounded wall, then an injection apparatus can be combined with a shaping pipe, as represented e.g. in conjunction with Fig.2. As the PUR firmly adheres to the substrate, i.e. is very tacky, said shaping pipe must have surface characteristics such that there is no firm adhesion of the resin. It is most advantageous to carry out teflonization (PTFE) of the pipe surface or a PTFE coating. If the uniform rounding is not essential, then an injection apparatus without a shaping pipe can be used.

Preferably working takes place without a shaping pipe. Usually the resin system can be applied in free foam form. The prepared, mixed resin system, with the uniform withdrawal of an injecting, extruding or casting head is sprayed onto the correspondingly pretreated sewer wall, from where the forming foam can rise freely or can completely form. This procedure is e.g. advantageous if a pipe section has to be sealed in a short time. However, this procedure leads to an irregular, not-level surface, which is less ideal from the flow standpoint, but in many cases is adequate. Subsequently a spraying head for the internal resin system mounted on a sliding carriage is drawn through the foamed pipe, from which the epoxy resin system is sprayed onto the PUR substrate. This procedure can also be very rapidly performed, so that the machinery does not have to be used for long. Curing then takes place through the introduction

of warm air into the particular pipe section until complete curing has taken place. Curing is generally completed after 24 hours and the sewer section is then ready for use again.

Optionally, a further, final covering layer can be applied but is generally unnecessary in the case of free foaming. The final layer is applied wherever special surface requirements make this necessary.

In the case of the present automatic machine foaming, numerous equipment and component parts are commercially available for the assembly of the apparatus used. Automatic mixing and injecting machines (casting machines) with a capacity of up to 100 kg/min are nowadays supplied by numerous manufacturers. These machines generally comprise a material container R1,R2 for each component and a dosing mechanism on which the necessary quantity ratio can be set, a mixing head M where the two components are mixed and a plurality of injection or extrusion nozzles S, through which the resin mixture passes out in homogenous form. The machines are generally provided with a temperature control for both components. Such a machine can be converted for the present process.

For the apparatus with a shaping pipe, which is not commercially available and forms part of the apparatus according to the invention, a commercially available mixing and injecting or extruding head is modified and installed in a shaping pipe of approximately 50 to 70 cm which, in much the same way as a telescopic pipe, comprises three to four telescopable rings. On the circumference of the outermost, first ring 5 in the pulling direction -> of the apparatus are installed the material nozzles (injection or casting mouthpieces). The following one or two rings 7,8 form the shaping and/or post curing zone. Such a shaping pipe can also be drawn through a sewer pipe bend, because it can be bent upto a given radius. Fig.2 shown

an embodiment of such a shaping pipe.

With the aid of a winch on a cable 10, the apparatus (which advantageoulsy has its own drive) is drawn or moved into the sewer pipe 1 to be repaired. By means of hoses 11 and not shown electrical connections, the apparatus is connected to units enabling the operating energy and means for the apparatus to be supplied. The apparatus has separate ducts R1 and R2 through which the resin components can be fed into the mixing chamber M. In the latter, where a mixing device 13 driven by a mixer motor 12 stirs, the resin components are mixed and the foamable resin mixture is supplied to the mouthpieces S through nozzle pipes 6, which are radial in cross-section and then ejected. A centring and sealing device 9 prevents any swelling out of the resin in the pulling direction, so that the resin spreading to form a foam passes counter to the pulling direction into the gap between ring portions 7,8. In the case of an intermittent advance speed corresponding to the tack-free time of 10 to 15 seconds, a foam layer of up to 2m can be cast or extruded in one minute.

The resulting intermediate layer, with or without a shaping pipe, is relatively smooth and sufficiently mechanically resistant that subsequently a sliding carriage for the epoxy resin injecting apparatus can pass through the same without damaging the intermediate layer surface.

The foaming with the insulating intermediate layer can be controlled in a random manner. At points with extensive damage, "casting" can continue until the damaged point is filled. Only when this has taken place is the spraying or casting apparatus drawn on again. This leads to a very flexible repair system because, despite the intermediate layer thickness, the expensive aftercoating with the mechanically and chemically resistant epoxy resin system always

occurs with the same thickness.

The presently proposed, rapidly reacting PUR foam, in the case of long sewer sections, permits a coverying layer application of the epoxy resin a relatively short time after foaming. The epoxy resin is the actual pipe part which will subsequently fulfill the function of the damaged sewer and for its curing, said pipe part requires 24 hours. However, as the intermediate layer only requires a fraction of this time, it can be assumed that a treated sewer section will be ready for use again after 24 hours as a result of forced postcuring, e.g. by flooding with hot air.

According to the process firstly an insulating priming layer is applied to a pipe to be lined and on said insulating priming layer is applied the mechanically and chemically stable layer to be sealed. For the sealing resin system, the priming layer forms the thermally and chemically correct substrate, on which the desired coating, despite dirt and wet in the sewer pipe, can be applied in such a way that correct hardening is possible and the service life corresponds to the material used.

In a further development of the process, a special coating process has been found, which only requires one coating operation and has no need for shaping means and therefore separating or parting means. This new coating process is a centrifuging process permitting a direct application to the e.g. concrete substrate in a sewer pipe and which can generally be performed in one operation. The polyurethane spraying foams are either poured manually or mechanically sprayed and the applied material can then rise. The liquid foaming gas contained in the mixture through the liquid - gaseous phase junction expands the viscose resin material and thus forms a closed-cell body with a limited specific gravity. On suppressing the rising or foaming process, there is a successive increase in the density of the coating

and a resin layer with few cells and a much higher specific gravity is obtained, which is completely tight and also mechanically stable. This lead to the idea of developing a one-coating method in place of the two-coating method having a similar resin base and using similar equipment. This has been made possible by the centrifuging process described hereinafter. In place of the resin material being cast, poured or sprayed, it is centrifuged onto the substrate, i.e. is applied to the pipe inner wall with a high kinetic energy. The resin layer formed in this way is tight, tough and hard.

In order that the thick layer applied does not flow back on the sewer bottom prior to curing and following the force of gravity, it must either be thixotroped by adding a thixotropic agent (obtainable for such resin systems), or in the same passage is applied in a less thick form, i.e. as a partial layer. Although the latter requires several passages, it is easier to conquer from the process standpoint.

According to this process, the final layer is only optional. If such a layer is desired, then the centrifuged layer in the same way as the foamed layer serves as a heat insulating substrate and although the heat insulating effect is less, it is still adequate. However, generally a subsequent coating with e.g. an epoxy resin is not necessary.

In order to repair a leaky sewer section, the following procedure is adopted. The pipe to be repaired and whose leaking points have been detected beforehand, e.g. by TV, is washed out by a known procedure, e.g. a water jet. After basic drying the still wet pipe (which must not have any puddles of water, which have to be sucked off if necessary) is sprayed with the isocyanate component of the polyurethane resin system used, in order to bind the residual surface moisture. This pretreatment is also

to be carried out when there is only a moderate amount of moisture and even if there is no moisture. This pre-treatment ensures that the resin layer does not become detached from the substrate and form bubbles. This pre-treatment leads to satisfactory service life characteristics of the repair layer in the sewer. In this example, preference is given to use of a resin system of Polylite VP-626 RG30/8664 of Reichhold Chemie AG, CH-5212 Hausen bei Brugg Switzerland, for hard polyurethane spray foam, particularly for mechanical spraying, whereby the mixing ratios can be obtained from the data sheet and instructions of the manufacturer, as well as the mixing specifications; or an equivalent resin system of type Resicast GH65 of Shell Chemie, a particularly strong polyurethane resin with good adhesiveness to concrete and with a residual elasticity in order to bridge cracks, whereby the mixing ratios can be obtained from the data sheet and instructions of the manufacturer, as well as from the mixing instruction.

This spraying can be performed with the same apparatus with which the resin system is centrifuged. After approximately 1 hour the isocyanate has adequately reacted with the water in order to serve as an adhesive substrate for the subsequent resin coating. This measure prevents any bubble formation or any detachment between the resin layer and the moist substrate. The same machine can then be used for applying the resin mixture by centrifuging to the prepared surface. As a result of the short cream time and tack-free time it is possible to insulate very difficult surfaces in a very short time. The resin application is set in such a way that the coating formed is approximately 0.5 to 1 cm thick (in exceptional cases up to 1.5 cm thick). At particularly difficult points, e.g. where there are breaks in the pipe, the advance can be slowed down, so that the coating becomes thicker and therefore stronger. The coating has good mechanical

characteristics as a result of its substantial freedom from pores.

Such a resin system gives a closed, watertight coating. The cream time is 2 to 3 sec and the tack-free time 10 to 15 sec, the ideal mixing temperature being 20°C. The compression strength of the cured coating is over $2kJ/m^2$, so that further working within the pipe structure is readily possible. The short curing time, which can be assisted by introducing warm air, makes it possible using a standard centrifuging apparatus to obtain a pipe formation speed of up to approximately 2m/min, which is very satisfactory.

The PUR resin readily adheres to the basically dried, but still moist concrete surface, or to the substrate pretreated with the isocyanate component. Optionally a further, bearing, hard, smooth and impermeable epoxy resin inner coating (final coating) can be applied, the PUR substrate being chemically and physically suitable for joining to the epoxy resin. These coating thicknesses are relatively thin compared with the PUR layer, preferably 0.5 to 1.5 mm thick, whereas the outer layer is preferably 0.5 to 1.5 cm thick, i.e. the ratio is 1:10.

The question of whether or not a final coating is to be applied depends on the desired flow needs within the sewer. As stated, the final coating can improve the strength of the overall coating system. It is also unnecessary to provide such a second coating over the entire pipe length. It need only be provided in the intended sections, because as a rule the PUR layer centrifuged in one pass is completely adequate.

If a final coating with an epoxy resin system is applied, then it is recommended to use a separate applicator for each resin system (epoxy and PUR), because these resin systems react with one another. Mutual contamination

can lead to clogging of the nozzles and resin supply means and such clogged material cannot be subsequently removed. As in this novel process no means for shaping the coating have to be provided, there is also no need for separating agents, so that the speed of advance can be very high. This is important, because a pipe section can be sealed in a very short time (also in emergencies). However, in the case of an unduly high speed of advance, an irregular surface can be obtained, which is not flat and is less ideal from the flow standpoint, although adequate in many cases. Curing generally lasts about one hour and can be assisted by introducing warm air into the appropriate pipe section. Complete curing is generally obtained after a few hours and the sewer section can then be used again.

In the case of the automatic resin centrifuging of the present type, numerous pieces of equipment are commercially available for the assembly of the apparatus to be used. Automatic mixing, centrifuging and spraying machines (casting machines) with a capacity of upto 50 kg/min are now supplied by many manufacturers. These machines normally comprise a material container for each component, a dosing mechanism on which the necessary quantity ratios can be set, a mixing head where the two components are mixed and a centrifugal head with a centrifugal nozzle directed onto the centrifugal disk, through which the resin mixture passes out and is distributed in a homogeneous form. The machines are generally provided with a temperature control for both components. Such a machine can be used for the present process.

The lining with the insulating intermediate layer can be controlled in a random manner. At points with extensive damage, "centrifuging" can take place until the damaged point has been filled. Only when this has taken place is the centrifuging apparatus moved on within the sewer. The apparatus is passed through the sewer in such a way that the rotation centre of the rotating centrifugal head passes along the longitudinal axis of the pipe, so that

the centrifuged-on coating is uniform. This gives a very flexible repair system, in which the parameters can be easily adjusted.

The presently proposed, rapidly reacting PUR-resin system, if necessary permits in the case of longer sewer sections, a final coating application with an epoxy resin relatively soon after the application of the previous coating. The epoxy resin is then the final pipe part, which will subsequently fulfil the function of the defective sewer and this pipe part requires about 24 hours for its complete hardening.

The presently proposed method eliminates all the known disadvantages of the various known procedures for sealing and repairing pipes, particularly sewer pipes. It makes use of existing aids in an advantageous manner and is inexpensive and unbelievably fast. The pipes or linings produced with this method have long service life characteristics, because they allow the resin systems to cure in a substantially ideal manner and these characteristics substantially coincide with those given for the corresponding systems.

CLAIMS

1. Process for sealing pipes, particularly sewer pipes, characterized in that a multicomponent resin mixture is directly applied to the inner surface of the sewer pipe for lining said inner surface.

2. Process according to claim 1, characterized in that in a prepared process stage, the inner surface of the sewer pipe is treated with the water-active component of the resin system.

3. Process according to claims 1 or 2, characterized in that the coating is produced from a hardenable two-component polyurethane resin.

4. Process according to claim 3, characterized in that prior to the application of the polyurethane resin mixture the pipe inner wall is pretreated with the isocyanate component of the resin mixture.

5. Process according to one of the claims 1 to 4, characterized in that the resin mixture is centrifuged onto the pipe inner wall.

6. Process according to claim 5, characterized in that the rotation centre of the rotating centrifugal head is pased along the longitudinal axis of the pipe.

7. Process according to claim 6, characterized in that the longitudinal movement is performed at a constant speed in order to obtain a uniformly thick coating.

8. Process according to claim 6, characterized in that the longitudinal movement is performed at a variable speed, so as to produce a thicker layer in certain areas.

9. Process according to one of the claims 5 to 8, characterized in that a thixotropic agent is added to the resin system.

10. Process according to claims 1 to 9, characterized in that a harder resin system is applied for forming a further sealing coating.

11. Process according to claim 10, characterized in that the additional sealing and harder coating is formed by an epoxy resin system.

12. Process for sealing pipes, particularly sewer pipes, characterized in that an insulating intermediate layer is applied between the pipe wall to be sealed and the coating sealing the same.

13. Process according to claim 11, characterized in that the insulating intermediate layer is produced by means of a foamed material.

14. Process according to claims 11 or 12, characterized in that the insulating intermediate layer is produced from a hardened foam.

15. Process according to one of the claims 11 to 13, characterized in that the insulating layer is produced from a hardenable polyurethane foam.

16. Process according to one of the claims 11 to 14, characterized in that a sealing layer is applied to the intermediate layer.

17. Process according to claim 15, characterized in that an epoxy resin system is used for forming the sealing layer.

18. Process according to one of the claims 15 or 16, characterized in that a further, final layer is applied to the sealing layer.

19. Process according to claim 17, characterized in that the final layer is formed from the same resin layer as the sealing layer.

20. Pipe lining comprising an insulating, looser resin layer to be closest to the pipe to be lined and a tight resin layer thereon.

21. Pipe lining according to claim 19, characterized in that the layer closest to the pipe to be lined is a rigid foam layer and the layer located thereon an epoxy resin layer.

22. Apparatus for lining pipes, particularly sewer pipes, which can be drawn through the pipe to be lined, characterized in that, apart from a mixing chamber (M) and a plurality of casting, pouring, spraying or extruding nozzles (6,S), it has a jacket pipe (5,7,8), which forms a circular casting or spraying chamber between itself and the pipe to be lined.

23. Apparatus according to claim 21, characterized in that the jacket pipe (5,7,8) is in several parts.

24. Apparatus according to claim 22, characterized in that the jacket pipe comprises a casting or spraying ring (5) and at least one following ring (7,8) movably arranged thereon, whereby the latter forms a postcuring zone.